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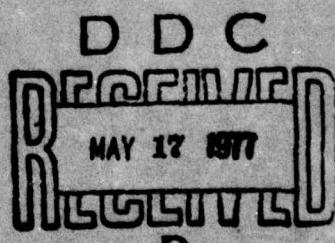
THE SOVIET CIVIL DEFENSE SHELTER PROGRAM

FINAL REPORT

LEON GOURÉ

CENTER FOR ADVANCED INTERNATIONAL STUDIES
UNIVERSITY OF MIAMI

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LEON GOURE

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Summary

An analysis of Soviet source material indicates that the Soviet authorities have devoted great attention to shelter construction since the inception of the shelter program in the 1950s. By the early 1960s, a considerable shelter capability had been achieved in industry, public buildings, schools, institutes, and new apartment buildings, as well as in the subways in Moscow and Leningrad, which U.S. observers in the Soviet Union learned to identify in 1962. In the 1960s, while shelter construction continued at industrial enterprises and public buildings, the Soviet authorities decided that it was too costly and difficult to provide the entire urban population with blast shelters and came to rely primarily on pre-attack urban evacuation as the method for protecting the population. In the 1970s, however, the Soviet civil defense program has again focused on shelter construction, with the stated aim of providing shelter protection for the entire population in the event that there is insufficient time to carry out the evacuation. Soviet sources indicate that this program is being implemented in urban as well as rural areas.

The Soviet shelters vary according to their purpose, hardness, and the sophistication of the filter-ventilation systems, as well as suitability for long-term occupancy. Soviet shelter types include extra-hard, multistory underground bunkers for use as government and military command posts and for the protection of the elite; multistory basement or large detached shelters for use as production facilities by defense-related industries and in conjunction with party, government and military headquarters; basement and detached shelters for protection of personnel in industry, public buildings, schools and institutes and large apartment buildings; hasty blast shelters in cities to supplement permanent protective structures, and various types of simple fallout shelters in rural areas, which are equipped with simple sand-gravel filters. High quality concrete with a compression ratio of

5,680 psi to 7,100 psi is used in the construction of permanent shelters. Basement shelters have heavily reinforced concrete roofs, 1-3 feet thick, usually supported by pillars 18 feet apart, and walls 2-4 feet thick. Hasty blast shelters are often built of prefabricated reinforced concrete blocks, 2-3 feet wide and high, and 5-6 feet long, which are placed in excavations and covered with 2-3 feet of earth. According to Soviet sources, depending on the purpose and location, the basement shelters are hardened for 1-10 kg/cm² (i.e., 14.2-142 psi) blast overpressure and provide a radiation attenuation factor of 1,000. Hasty shelters are hardened to 28.4 psi, with a radiation attenuation factor of up to 550. Shelter capacities in basement and detached shelters range from 50 to 1,000, and much more in the case of subways or adapted mines. Considerable interest is shown in dual-purpose shelters for use in peacetime as underground garages, restaurants, laboratories, and manufacturing. Use is also made of adapted underground pedestrian walkways and transportation tunnels.

While permanent shelters are equipped with filter-ventilation systems, sometimes supplemented with air regeneration units and bottled oxygen, reserves of drinking water and toilet facilities, only industrial or shelters for the elite are provided with a prestocked supply of food. The lack of such food reserves in apartments, schools, institutes and other shelters will limit the time of occupancy. Generally, the Soviet shelter system appears to be planned for an occupancy of one to five days, since it is expected that the occupants will be rescued and evacuated to safer areas in this amount of time following an attack.

Soviet sources indicate that the amount of ready shelter space is growing, both as a result of the compulsory addition of shelters to new buildings, and as a result of compulsory construction of hasty shelters during the course of the comprehensive exercises which have been held since 1973 throughout the USSR. Despite Soviet public attempts to deny the significance of the Soviet civil defense program for the U.S.-USSR strategic balance, leading Soviet spokesmen admit publicly at this time that "methods of protecting the population and the national economy against attacks" are "constantly being improved."

The Soviet Civil Defense Shelter Program

Introduction

ACCORDING TO SOVIET civil defense spokesmen, "the sheltering of the population in protective structures is one of the important methods of protection against the casualty-causing effects of weapons of mass destruction,"¹ i.e., nuclear, chemical and bacteriological weapons. Indeed, not only do Soviet authorities assert that "the preparation of shelters is a matter of great importance for the state," but they make clear that the protection of essential elements of the population and of industry is a fundamental requirement for the successful waging of a nuclear war and the attainment of victory.² The priorities attributed to shelters in the post-World War II Soviet civil defense program have fluctuated, depending in large

¹M. N. Titov, P. T. Egorov and B. A. Alabin, *Grazhdanskaia Oborona*, (Moscow: Vys-shaia Shkola, 1974), p. 33.

²See Leon Gouré, *War Survival in Soviet Strategy: USSR Civil Defense*, Monographs in International Affairs (Coral Gables: Center for Advanced International Studies, University of Miami, 1976), *passim*.

measure on Soviet investment capabilities. It is evident, however, that in the 1970s the shelter construction program has been moved to the fore as the main method for protecting vital production and the population in the event of a sudden outbreak of a war or a rapidly escalating crisis. This increased emphasis on shelters appears a logical development, given Soviet reliance on a first counterforce strike strategy and the leadership's desire to be able to cope with a rapidly escalating crisis which would not provide sufficient strategic warning to implement more time-consuming civil defense measures.

Soviet Views on the Need for Shelters

Shelters have been a part of the Soviet civil defense program from its inception in 1932. While during World War II the population used simple bomb shelters, i.e. basements and slit trenches, more elaborate facilities had been built for the elite, in particular, the adaptation of several subway stations and tunnels in Moscow for the use of the leaders in the Kremlin. Immediately after the war a debate took place over the utility of shelters as a means of protection against nuclear weapons. It is reported that "the use of shelters was questioned and it was suggested that they did not meet modern requirements."³ This view, however, was judged to be "extreme," and the decision was made for the MPVO, or Local Anti-Air Defense, as the organization was then called, to develop a shelter program for protection against nuclear weapons effects.

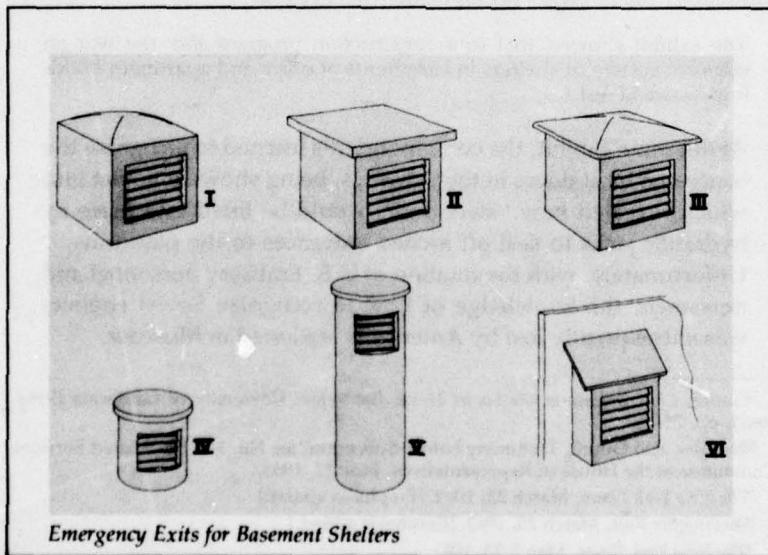
Major attention was paid to shelter construction in the 1950s. The MPVO specified at that time that the protection of the population "from all means of attack from the air" was to be achieved in "structures specially built or adapted for this purpose," i.e., detached and basement shelters in factory, public and apartment buildings, as well as subways and other existing underground structures.⁴ In the 1950s all plans for new buildings required the approval of the MPVO au-

³Lieutenant-General G. Malin, *Sovetskaia Rossiia*, June 5, 1968.

⁴*Uchebno-Metodicheskoe Posobie po Provedeniiu Trenirovok i Priemu Norm "Gotov k PVO"* 1-i Stupeni (Moscow: DOSAAF, 1959), p. 32. See also, Colonel-General A. T. Altunin, "Principal Stages and Directions of Development of USSR Civil Defense," *Voenno-Istoricheskii Zhurnal*, No. 11, November 1976, pp. 39-47.



Shelter Exit



Emergency Exits for Basement Shelters

thorities, and all industrial or large buildings were required, as a rule, to be equipped with shelters.⁵

By the early 1960s there was a good deal of hard evidence that a considerable amount of shelter space in factories as well as public and apartment buildings had been built, and that the Moscow and Leningrad subways had been equipped with concealed blast doors at the entrances to the station platforms and in connecting crosswalks.⁶ An ongoing debate in the U.S. at that time concerning the existence of a Soviet civil defense program was largely resolved when, in 1962, U.S. military attaches and newsmen visited the Permanent Civil Defense Exhibit in Moscow and learned how to identify the telltale external features of Soviet shelters, namely their emergency exits, which are normally located at some distance from the building housing the shelter. Commenting on his visit to this exhibit, *New York Times* correspondent Seymour Topping reported in March 1962:

The above ground extensions of shelters *now identifiable* have been found to be numerous in Moscow. Travelers have seen them in other Soviet cities too. . . . These installations can be seen in the courtyards at various distances from public buildings.⁷

Similarly, the *Reuters* correspondent wrote that

The exhibit showed that in a construction program *after* the war an extensive system of shelters in basements of office and apartment buildings was laid out.⁸

At the same exhibit, the correspondents learned to recognize the concealed blast doors in the subways, being shown a Soviet film which revealed how "steel doors would be lifted into place by hydraulic jacks to seal off arched entrances to the platforms."⁹ Unfortunately, with the rotation of U.S. Embassy personnel and newsmen, the knowledge of how to recognize Soviet shelters was subsequently lost by Americans stationed in Moscow.

⁵Gouré, *Civil Defense in the Soviet Union* (Berkeley: University of California Press, 1962), pp. 79-110.

⁶*Ibid.* See also Gouré, Testimony before Subcommittee No. 3 of the Armed Services Committee of the House of Representatives, June 17, 1963.

⁷*The New York Times*, March 23, 1962. [Emphasis added.]

⁸*Washington Post*, March 25, 1962. [Emphasis added.]

⁹*The New York Times*, March 23, 1962.

Despite extensive shelter construction during this period, the authorities came to recognize that the effort to provide effective protection against "all casualty-producing effects" of nuclear weapons for the entire population in high risk areas was slow and costly. Consequently, in the late 1950s it was decided to rely primarily on pre-attack urban evacuation and dispersal as the best means for protecting the majority of the urban residents, and to give priority in shelter construction to those essential workers and employees who would be required to remain in the cities in order to maintain vital industrial production and services, as well as for the political, administrative and military elite.¹⁰ Thus, while shelter construction continued in the 1960s, and spokesmen claimed that the Soviet leadership was devoting a great deal of attention to it,¹¹ it was also said that

To create them for the entire population of the country requires enormous resources and many years of intensive work. As yet, this is not within the capability of any, even the most developed country, to do.¹²

A thorough reassessment of the Soviet civil defense program was undertaken in the early 1970s, resulting in a major shift in Soviet views on requirements for shelters. The USSR Chief of Civil Defense, General of the Army A. T. Altunin, who had been appointed to that post in 1972, announced in November 1973 that "decisive changes have taken place with regard to maximum use of all available engineering structures in the interest of protecting the population."¹³ The following year Altunin explicitly called for USSR civil defense "to be constantly prepared to shelter the *entire* population in protective structures."¹⁴

¹⁰Altunin, "Principal Stages," *Voenno-Istoricheskii Zhurnal*, No. 11, November 1976, pp. 43-44; Marshal of the Soviet Union V. I. Chuikov, *Grazhdanskaia Oborona v Raketno-ladernoi Voine* (Moscow: Atomizdat, 1968), p. 16.

¹¹Chuikov, *Izvestia*, June 15, 1968; Gouré, *Soviet Civil Defense Revisited 1966-1969*, The RAND Corporation, RM-6113-PR, November 1969, pp. 22-27.

¹²V. A. Beliavskii, *Grazhdanskaia Oborona, Vsenarodnoe Delo* (Moscow: Atomizdat, 1968), p. 9. See also M. V. Kachulin, *Beseda s Naseleniem o Grazhdanskoi Oborone* (Moscow: Atomizdat, 1970), p. 32.

¹³*Sovetskii Patriot*, November 21, 1973.

¹⁴Altunin, "An Important Aspect of Training," *Uchitel'skaia Gazeta*, August 22, 1974 [emphasis added]; and in *Liudi i Dela Grazhdanskoi Oborony* (Moscow: Voenizdat, 1974), p. 9.

Soviet spokesmen have advanced various explanations for this shift in emphasis to shelters. Altunin himself has pointed to the increase in "the accuracy of delivery of nuclear weapons" and in their yields, and asserted that "the task of civil defense is to raise to the maximum the reliability of the protection of the population from the first hour of a war under any conditions of its initiation,"¹⁵ i.e., under conditions where there would be insufficient warning to carry out the pre-attack evacuation of the cities. Therefore, Altunin argued that the construction of such shelters, which he acknowledged to be a "difficult task," was essential, and presumably no longer too costly or impractical. Altunin also claimed that the earlier primary reliance on the evacuation of urban residents had been forced upon Soviet civil defense by the lack of sufficient "reliable shelters" and the long lead time required to build them in large numbers, but he suggested that this situation had changed and that it had become possible now to shift the emphasis to shelters for everybody.¹⁶ Other Soviet spokesmen argued in 1975 that an enemy might attempt to deliver pre-emptive strikes on the Soviet Union or carry out a surprise attack, and that there might not be sufficient time to implement the evacuation of urban residents.

Now, when there has been further development and improvement of nuclear missiles and strategic aviation, in case a war breaks out the aggressor may attempt to deliver a forestalling nuclear attack. . . . Under these conditions, the time period for performing protective civil defense measures may be extremely limited, especially those for carrying out dispersal and evacuation. Consequently, today a plan for sheltering the population in protective structures has been brought to the fore as the most reliable one for saving the lives of peoples from nuclear missiles.¹⁷

Soviet officials told the same story to Finnish civil defense officials during the latter's visit to the Soviet Union during the summer of 1973. According to one of these officials:

In recent years ever-increasing attention has also been paid to shelter protection. Consequently, after 1970, the construction of shelters has

¹⁵Altunin, *Liudi i Dela Grazhdanskoi Oborony*, p. 9.

¹⁶Altunin, "Principal Stages," *Voenno-Istoricheskii Zhurnal*, No. 11, November 1976, p. 45.

¹⁷K. G. Kotlukov, K. S. Oglomin, and A. I. Sgievskii, *Grazhdanskaia Oborona Vchera i Segodnia* (Moscow: Atomizdat, 1975), cited in JPRS, *Translations on USSR Military Affairs*, GUO 32/76, July 8, 1976, pp. 19-20.

increased and the design of radiation shelters and construction of prototype shelters are carried out at present over all the country.¹⁸

The increased emphasis on shelters is reflected also in the activity reports of local civil defense chiefs. For example, the Chief of the Civil Defense Staff of the Lithuanian Republic wrote in 1974 that in the city of Vil'nius "the tasks of constructing dugouts and shelters for workers and employees are being successfully carried out in many of the city's plants."¹⁹ The Chief of the Civil Defense Staff of the Uzbek Republic asserted that "the main attention will be devoted to the construction of shelters and various covers."²⁰ The Chairman of the Executive Committee of the Baku City Soviet (i.e., council) wrote that "the question of the construction and maintenance of protective structures has become especially important."²¹ It was reported that in the Turkmen Republic "particular attention was paid to the organization of the population's protective facilities [i.e., shelters], the keeping in readiness of existing shelters and covers and those under construction."²² It was noted in the Kirgiz Republic that "a great deal of attention is being devoted to the construction of shelters."²³ In November 1976 the Chief of the Lithuanian Civil Defense Staff declared that "as in previous years, principal attention was paid to the building of protective structures."²⁴

The increased focus on shelters in recent years does not mean that urban evacuation and dispersal have been dropped from the Soviet civil defense program. As is noted in a 1975 civil defense manual, "the greatest effect in the protection of the population is achieved by combining the methods of [protection in] shelters with dispersal and evacuation of people to safe areas in the out-of-town zone."²⁵ Indeed, Soviet publications continue to report further work on evacuation

¹⁸Erkki Mäntyvaara, *Viestösuoelut Lehti* (Helsinki), No. 2, 1974.

¹⁹Major-General S. Stalauskas, "To Improve Civil Defense," *Kommunist* (Vil'nius), No. 11, November 1974, p. 73.

²⁰Major-General S. Akhundzhanov, "Each of Us Must Know How and Be Able To," *Pravda Vostoka*, February 21, 1975.

²¹A. Mamedov, "To Learn to Lead," *Voennye Znaniia*, No. 8, August 1974, p. 22.

²²N. Lysov, "In the Civil Defense Organization," *Turkmenskaia Iskra*, June 12, 1974.

²³M. Fakhrutdinov, "Formation of a Defense Fund," *Sovetskaia Kirgizia*, July 27, 1976.

²⁴Stalauskas, Radio Vil'nius, November 26, 1976.

²⁵Kotlukov, et al., *Grazhdanskaia Oborona Vchera*, p. 20.

plans and the preparation of rural areas to receive and shelter evacuees, the holding of evacuation exercises in various parts of the Soviet Union, and the instruction of the population in evacuation procedures.

Improvements in evacuation procedures parallel the increased emphasis on shelters. In 1973 the Soviet authorities introduced a program of evacuation on foot of "a significant portion of the urban population . . . in organized columns, according to the appropriate schedule and along pre-planned and previously prepared routes,"²⁶ and they have dropped the earlier requirement for the pre-departure registration of, and the issuing of passes to, evacuees,²⁷ in order to accelerate the rate of evacuation and solve the transportation problem.

The willingness of the Soviet authorities to invest in a greatly expanded shelter construction program indicates not only the importance which they attribute to civil defense in general as a part of the overall Soviet defense and war-fighting posture, but also a decision to increase the flexibility of Soviet civil defense capabilities, so as to be prepared for war under any condition of its initiation.

Characteristics of Soviet Shelters

Since the 1950s, the Soviet Union has built a variety of types of shelters and has also adapted various underground structures for shelter purposes. The types of shelters range from heavy, multistory underground bunkers, to basement shelters and hasty blast shelters in urban areas and at industrial installations, to simple fallout shelters in rural areas. It is specified that

The plans provide that workers and employees of major cities and important national economic installations who continue to work in wartime as the basic production force are to be provided with cover in shelters which will protect them against all destructive effects of nuclear weapons. In addition, at the appearance of a threat of enemy attack, it

²⁶*Ibid.*

²⁷Colonel A. Zaitsev, "The First Lessons: The Time Has Come to Glean Them from Complex Exercises Already Held at Production Facilities," *Voennoye Znaniiia*, No. 6, June 1976, p. 18.

is possible to use as shelters basements, deep underground facilities and structures adapted for this purpose.²⁸

In the rural areas fallout shelters are "set up in basements, cellars, vegetable storage cellars, mines, shafts and natural caves,"²⁹ or in specially built dugouts or trenches covered with earth.

Permanent shelters in potential target areas are either detached shelters or are built into the basements of buildings during their construction or renovation. Detached shelters are usually built at enterprises where no renovations are planned in the near future, or where special ground conditions exist making it inexpedient to build basements in buildings.³⁰

In the 1950s and part of the 1960s, Soviet buildings were frequently made of brick. They were usually four or five stories high and equipped with shallow basements. Increasingly, however, the practice has been to construct buildings of prefabricated reinforced or prestressed structural concrete units, and for public and apartment buildings to be nine or more stories high, with deeper basements. In 1976, the Soviet Union produced 117 million cubic meters of such prefabricated concrete sections. Of this total, some 19-20 million cubic meters were in prefabricated reinforced concrete wall sections and reinforced concrete blocks used in underground construction such as tunnels and mines as well as shelters, and some 26 million cubic meters were of sectional prestressed concrete.³¹ Soviet cement production, which in 1976 amounted to 124 million metric tons, is planned to reach 143-146 million metric tons by 1980.³² As a rule, structural reinforced concrete units used in shelter construction are made of high quality cement. Soviet concrete is graded from 100 to 600, each grade representing the amount of compression the particular grade of cement can stand, expressed in kg/cm², with shelters usually being built of components made of 400-500 grade concrete

²⁸Kotlukov, et al., *Grazhdanskaia Oborona Vchera*, p. 20.

²⁹*Ibid.*

³⁰Fakhrutdinov, "Formation of a Defense Fund," *Sovetskaia Kirgizia*, July 27, 1976.

³¹Central Statistical Administration of the USSR Council of Ministers, *Narodnoe Khoziaistvo SSSR v 1974 godu* (Moscow: Stastika, 1975), p. 263; "Results of the State Economic Plan for 1976," *Izvestia*, January 23, 1977.

³²*Osnovnye Napravleniya Razvitiia Narodnogo Khoziaistva SSSR na 1976-1980 gody* (Moscow: Politizdat, 1975), p. 43; *Izvestia*, January 23, 1977.

(i.e., with a compression ratio of 5,680 psi to 7,100 psi).³³ Hasty blast shelters are built primarily of reinforced concrete blocks, 2-3 feet thick, and 4-5 feet long, or concrete plates or panels up to 15 centimeters thick.

Depending on the purpose, the walls of detached and basement shelters are from 0.5 to 1.2 meters thick, and more in the case of special shelters. The roofs of basement shelters are designed to be able to bear the weight of the collapsed building above, most often being made of either prefabricated reinforced plates or cast reinforced concrete, 12 centimeters to 50 centimeters thick. In shelters 12 or more meters wide, the roof will usually be supported by pillars of reinforced concrete every six meters. In some cases, a layer of sand is placed between two layers of reinforced concrete plates. In the case of detached shelters, the roof plates will be covered by some three feet of earth.

The hardness of the shelters varies considerably. A 1972 Soviet manual states that the shelters must be able to withstand blast overpressures of 1-10 kg/cm² (i.e., 14.2 psi to 142 psi).³⁴ Special shelters for key defense industry essential storage and command posts may be designed for considerably greater hardness.³⁵ Other manuals, however, cite different figures for standard Soviet shelters. Thus, some say that shelters are hardened in the range of 0.5 to 5 kg/cm² (7.1 psi to 71 psi), or to 1 to 3 kg/cm² (14.2 psi to 42.6 psi), and that hasty blast shelters should withstand 0.5 to 3 kg/cm² (7.1 psi to 42.6 psi) overpressure.³⁶ It is noted that a shelter hardened to 1 kg/cm² (14.2 psi)

³³Central Statistical Administration of the USSR Council of Ministers, *Narodnoe khoziaistvo SSSR v 1975 godu* (Moscow: Statistika, 1976) p. 790. In 1975 the Soviet Union produced 22.2 million metric tons of 300 grade cement, 73.4 million tons of 400 grade cement, 21.9 million tons to 500 grade cement, and 329 thousand tons of 600 grade cement. *Ibid.*, p. 277.

³⁴P. G. Iakubovskii, *Grazhdanskaia Oborona* (Moscow: Prosveshchenie, 1972), p. 26.

³⁵*The New York Times*, January 3, 1977. According to Major General Keegan, former Assistant Chief of Staff for Intelligence, Headquarters USAF, some of the underground command posts identified by intelligence around Moscow are estimated to be hardened to 1,000 psi.

³⁶N. P. Krechetnikov, N. P. Olavianishnikov, *Grazhdanskaia Oborona na Mashinostroitel'nykh Predpriatiakh*, 2nd edition (Moscow: Mashinostroenie, 1972), p. 27; A. A. Gromov and N. P. Krechetnikov, *Grazhdanskaia Oborona Promyshlennogo Objekta* (Moscow: Atomizdat, 1975), p. 35; F. I. Ostroukh, *Stroitel'stvo Bystrovozvodimykh Ubezishch i Protivoradiatsionnykh Ukrtyii* (Moscow: Voenizdat, 1972), p. 4; and "From Prefabricated Construction," *Voennye Znaniia*, No. 8, August 1972, pp. 25-26.

will survive with no damage to the shelter the overpressure generated by the detonation of a one megaton ground burst nuclear weapon at 2.8 to 3 kilometers from ground zero, and that shelters hardened to 2 to 3 kg/cm² (28.4 psi to 42.6 psi) will survive at 1.5 to 2 kilometers from ground zero.³⁷ Permanent blast shelters are said to usually provide a radiation attenuation factor of 1,000. It is also said that a layer of one meter of earth over the roof of a detached shelter will provide this level of radiation attenuation.

The size of shelters ranges from a 50-person capacity to over 1,000-person capacity. Basement shelters in apartment houses generally appear to be built with a 150 to 300-person capacity, calculated on the basis of a minimum of 1.5 cubic meters (53 cubic feet) or 0.5 square meters (5 square feet) per person where the height of the shelter is 2.2 meters.³⁸ As a rule, shelters at industrial enterprises must have sufficient space for one workshift.³⁹ Shelters designed to protect production facilities, be they multistory basement shelters or detached shelters, will presumably have sufficient space for machinery and equipment in addition to one workshift.

The Soviet authorities also recommend a dual purpose use of shelters. Thus, according to Altunin:

The solution of the problem of providing the population with anti-nuclear shelters is made easier by the possibility of building dual-purpose shelters which in peacetime can be used as garages, stores, movie theaters, temporary storage areas, and by various agencies of DOSAAF and Civil Defense (for rifle ranges, classrooms, exhibits).⁴⁰

Indeed, it has been the practice to rent out shelters for storage or for laboratory space, for use as cloakrooms or as classrooms.⁴¹ However,

³⁷Kachulin, *Beseda s Naseleniem*, p. 26.

³⁸Titov, et al., *Grazhdanskaia Oborona*, p. 34; F. G. Krotkov, *Meditinskaiia Sluzhba Grazhdanskoi Oborony* (Moscow: Meditsina, 1975), in JPRS, *Translations on USSR Military Affairs*, No. 1141, May 9, 1975, p. 25.

³⁹Titov, et al., *Grazhdanskaia Oborona*, p. 33; N. I. Akimov and V. G. Il'in, *Grazhdanskaia Oborona na Obektakh Sel'skokhoziaistvennogo Proizvodstva* (Moscow: Kolos, 1973), p. 171.

⁴⁰Altunin, *Liudi i Dela Grazhdanskoi Oborony*, p. 9.

⁴¹Fakhrutdinov, "Formation of a Defense Fund," *Sovetskaia Kirgizia*, July 27, 1976; I. A. Onufriev and A. S. Danilevskii, *Spravochnik Inzhenera-Stroitelia* (Moscow: Stroizdat, 1970), cited in JPRS, *Translations on USSR Military Affairs*, No. 1240, July 14, 1976, p. 2; I. Trudov, "The Place of Training—The Shelter," *Voennye Znaniia*, No. 3, March 1975, p. 26.

the conditions are that the shelter equipment be maintained in working order and that it can be cleared for occupancy in a couple of hours.

Soviet sources indicate that efforts have been made to adapt underground garages, rifle ranges and canteens for shelter purposes.⁴² There are also instructions on how to adapt pedestrian and transportation tunnels for shelter purposes.⁴³ In addition, the deep subway systems in Moscow, Leningrad, Kiev, Tbilisi, Baku and Kharkov have been adapted for shelter purposes.

Permanent blast shelters are also characterized by their filter-ventilization systems and are classified according to their degree of independence from external air. The ultimate type is a totally self-contained system which makes no use of external air but relies entirely on air regeneration and enrichment from bottled compressed oxygen. (A standard oxygen balloon has a 6-cubic meter capacity.) Such systems presumably would be used only in special cases where it is intended to provide maximum protection for the shelter occupants. The next type is called a system of "pure air," which makes partial use of external air, but also includes blast attenuators, carbon monoxide scrubbers, heat absorbers, dust filters, multi-cannister chemical filters, and in addition, air regeneration systems supplemented by bottled oxygen or air.⁴⁴ The more common type is called a "filter-ventilation" system, and is composed of blast attenuators, dust filters and electric or manually-operated multi-cannister chemical filter-fans. This system relies entirely on external air. In addition, there are various types of dust filters and sand-gravel filters, as well as bicycle or hand-operated fans for use in blast shelters or simple fallout shelters.⁴⁵ In 1973, the production of a new

⁴²Iu. Kammerer and A. E. Kharkevich, *Ekspluatatsiya Ulbezishch Grazhdanskoi Oborony* (Moscow: Stroizdat, 1970), *passim*; S. Karandaev and N. Silverstov, "Practice at the Installations," *Voennye Znaniia*, No. 7, July 1976, p. 35; Lieutenant-Colonel N. Moskvichev, "With Confidence in People," *Voennye Znaniia*, No. 11, November 1976, p. 34.

⁴³Kammerer and Kharkevich, *Ekspluatatsiya*, *passim*.

⁴⁴Titov, et al., *Grazhdanskaia Oborona*, pp. 37-40; A. Sudakov and A. Tsurikov, "Air Is Life," *Voennye Znaniia*, No. 6, June 1972, pp. 25-27; Sudakov, *Zashchita Naseleniya ot Radioaktivnykh Osadkov* (Moscow: Atomizdat, 1973), pp. 39-41.

⁴⁵Onufriev and Danilevskii, *Spravochnik*, p. 9; Kachulin, *Beseda s Naseleniem*, p. 58; D. I. Shuvyrin, *Zashchita Naseleniya—Glavnaya Zadacha Grazhdanskoi Oborony* (Moscow: Grazhdanskaia Oborona, 1970), p. 18; P. T. Egorov, I. A. Shliakhov and N. I. Alabin, *Grazhdanskaia Oborona* (Moscow: Vysshiaia Shkola, 1970), pp. 200-206; V. Guliaev, "Only to Complete the Equipping," *Voennye Znaniia*, No. 6, June 1973, pp. 32-33.

electric low-pressure fan for ventilation systems in small capacity shelters was announced.⁴⁶ Large shelters may have diesel electric power generators to provide power in the event of a breakdown of the electrical system.⁴⁷ The "pure air system" is said to provide 7 to 20 cubic meters of air per person per hour, while the "filter-ventilation" system provides at least 2 cubic meters of air per person per hour.⁴⁸ The minimum norm is 2 to 5 cubic meters per hour per person for short-term shelter occupancy (i.e., up to 12 hours), and 7 to 20 cubic meters per hour per person for long-term occupancy.

In order to guard against contamination of the air in the shelters, as well as to protect the entrances against blast damage, the shelters are equipped with hermetically-sealing metal doors edged with rubber. There are several types of such doors: cylindrical convex doors with concrete filling, cylindrical concave metal doors, metal plate doors with wheel or plate wedge locking mechanisms.⁴⁹ Generally, these doors are either 0.8×1.8 meters or 1.2×2 meters, depending on the size of the shelter, and have 15-centimeter-high thresholds.⁵⁰ Usually the shelters will have double metal doors at entrances forming an air lock (1.4×1.4 meters or 1.6×1.6 meters), and with the doors at right angles to each other. In addition, the air pressure in the shelter will be kept higher than the external air (approximately 5 to 7 millimeters on a water-air pressure reading set), to prevent the seepage of toxic gas and smoke into the shelter, and to insure the proper functioning of the air exhaust.

Permanent shelters, especially those under buildings must be provided with one or more emergency exists, in the event that the shelter entrances are blocked by debris. These emergency exits, usually in the shape of square concrete structures 0.9×0.9 meters, or circular ones with a diameter of 0.9 meters and 1.2 meters high, and an opening on one side, normally covered with wooden louvers, must be located at a distance from the nearby building equal to one-half of the height of the building plus three meters, in order to reduce the

⁴⁶Engineer-Colonel V. Chebotarev, "Electric Low-Pressure," *Voennye Znaniia*, No. 7, July 1973, p. 36.

⁴⁷Titov, et al., *Grazhdanskaia Oborona*, p. 39.

⁴⁸*Ibid.*, p. 38-39.

⁴⁹Onufriyev and Danilevskii, *Spravochnik*, pp. 16-17.

⁵⁰Kammerer and Kharkevich, *Ekspluatatsiia*, p. 10.

danger of it being buried under debris. The exit is connected to the shelter by a vertical shaft and a tunnel 0.9×1.3 meters or 1.2×2 meters in height and width, and sealed at the shelter end with double metal doors.⁵¹ The exits may also house the air intake for the filter-ventilation system and the blast attenuator. The emergency exits, as noted, are the most visible external indication of the presence of a nearby shelter. As a rule, these exits are located in the courtyards or nearby squares or parks, rather than on the street side, where the width of the sidewalk is usually insufficient for the required length of the exit tunnel. Detached shelters do not necessarily have emergency exits, since they usually have more than one entrance, and are sufficiently far from buildings to avoid being buried under debris. Sometimes detached shelters are connected with the nearby building by tunnels.⁵²

All shelters intended for prolonged occupancy are equipped with toilets and water. In the event that the external water and sewage pipes are destroyed, the shelters are also provided with a reserve of drinking water and septic tanks or other types of containers for waste.⁵³ Large shelters may have their own wells.⁵⁴ The shelters must also be equipped with radio receivers, telephones, dosimeters, flash lights, fire extinguishers, shovels, picks and buckets. Soviet publications describe two types of remote reading radiation indicators for determining external radiation levels from the shelters. One type, Model DP-64, is battery powered and operates in the follow-up mode, which provides an audio and light signal when the level of gamma radiation reaches 0.2 rads per hour.⁵⁵ The other, a radiation meter, type DP-3B, measures gamma radiation on four scales: 0.1-1 rad per hour, 1-10 rads per hour, 10-100 rads per hour, and 50-500 rads per hour.⁵⁶ This device is also mounted on vehicles for radiation surveys.

⁵¹Titov, et al., *Grazhdanskaia Oborona*, pp. 36-37.

⁵²For example, see D. Solovev, "In Counted Seconds," *Voennye Znaniia*, No. 12, December 1976, p. 31.

⁵³Titov, et al., *Grazhdanskaia Oborona*, p. 39; Kammerer and Kharkovich, *Ekspluatatsiiia*, pp. 63-68.

⁵⁴Onufriev and Danilevskii, *Spravochnik*, p. 7; Kammerer and Kharkevich, *Ekspluatatsiiia*, p. 66.

⁵⁵"The DP-64 Indicator Signalling Device," *Voennye Znaniia*, No. 2, February 1976, p. 24.

⁵⁶"Radiation Meter DP-3B," *Voennye Znaniia*, No. 4, April 1976, p. 49.

Considerable attention is paid to the planning and design of hasty blast shelters, making use of various precast reinforced concrete structural components, such as pipes with a diameter of 1.5-2 meters, as well as reinforced concrete blocks 2-3 feet thick and plates or steel plates.⁵⁷ Normally, such shelters are built in a trench with a right angle or straight entrance and blast doors, and the concrete structure is then covered with 2-4 feet of earth. As was noted, such shelters are estimated to be able to withstand from 14.2 to 46.8 psi overpressure.

The wide variety of fallout shelters is designed primarily to provide effective protection against radiation, rather than blast overpressure. Basements in one-story houses or semibasements can be adapted by bricking in the windows and banking earth against the walls, as well as by placing 1-2 feet of earth on the floor above and reinforcing the ceiling with several upright beams. This is said to increase the attenuation coefficient by 300.⁵⁸ For dugouts and covered trenches, use can be made of round timber, boards, bricks, sheet metal, fascines, and so on, covered with 2-3 feet of earth. The degree of radiation attenuation will vary (between 10 and 550), depending on whether the shelter has straight or right angle entrances, and whether 1, 2 or 3 feet of earth is used as cover. According to Soviet publications, such a shelter with a right angle entrance and covered with 60 centimeters (i.e. 2 feet) of earth, will provide at its center a radiation protection factor of 550.⁵⁹ Waterproofing of such shelters is accomplished by means of covering the roof and walls with layers of 20-25 centimeters of pressed clay as well as tarpaper, and digging a gravel-filled drainage trench under the center of the shelter.⁶⁰ In addition fallout shelters should be provided with a reserve of drinking water and food,⁶¹ presumably allowing 3.5-4 liters of water per person per day.⁶²

One significant factor, according to Soviet sources, is the speed with which hasty blast and fallout shelters can be built in an

⁵⁷Ostroukh, *Stroitel'stvo*, p. 4; also, "From Pre-fabricated Parts," *Voennye Znaniia*, No. 8, August 1972, pp. 24-26; and "Where There Is . . ." *Voennye Znaniia*, No. 1, January 1974, p. 24; *Voennye Znaniia*, No. 5, May 1975, p. 39; Iakubovskii, *Grazhdanskaia Oborona*, p. 30.

⁵⁸Akimov and Il'in, *Grazhdanskaia Oborona na Obektakh*, p. 174.

⁵⁹Titov, et al., *Grazhdanskaia Oborona*, p. 41.

⁶⁰Akimov and Il'in, *Grazhdanskaia Oborona na Obektakh*, p. 176.

⁶¹Titov, et al., *Grazhdanskaia Oborona*, p. 41.

⁶²Krotkov, *Meditinskaia Sluzhba*, p. 22.

emergency in rural areas and small towns. Where possible, construction will be carried out with the use of mechanized equipment, such as bulldozers, mechanical shovels, motorized cranes, and so on. The time required for the construction will vary with the size of the shelter and of the construction force employed, as well as with the availability of pre-stocked building materials. According to Soviet sources, adapting a basement for occupancy for 6-7 persons will require 5-6 hours with a work force of 6-7 persons; a separate shelter built from round timber for 25 persons can be built in 12-16 hours by a 14-man work team; shelters made of large concrete drainage pipes or ducts with the use of a 10-12-man work team and employing earth-moving equipment and a crane, for occupancy for 50, 100, 150 and 200 persons will require 28, 47, 60 and 70 hours of construction time, respectively; shelters built from large metal pipes 60-70 meters in length require approximately 30 man-hours to complete; adapting a vegetable cellar for occupancy for 20-30 persons will require 90-100 man-hours; and a factory basement for occupancy for 200 persons, approximately 24 hours; the adaptation of a mine to a shelter for the occupancy of 7,000 persons required 114 man-hours.

Soviet Views on Duration of Shelter Occupancy

While noting that in the U.S. planning for shelter occupancy may be as much as two weeks, Soviet doctrine does not prescribe a general fixed duration of occupancy.⁶³ Instead, it is said that "the duration of stay in blast or fallout shelters depends on the rate at which local radiation declines."⁶⁴ In essence, Soviet doctrine envisages the earliest possible transfer of shelter occupants to nearby undamaged buildings or their evacuation to safe areas, taking into account that the permissible one-time dose of exposure to radiation should not exceed 50 rads.

According to Soviet instructions, the area of radioactive contamination is divided into three zones: the zone of light radiation, or Zone A,

⁶³Krotkov, *Meditinskaia Sluzhba*, p. 20.

⁶⁴Sudakov, *Zashchita*, pp. 55-56.

where at the outside border line the level of radiation is 40 rads and the dose rate one hour after the nuclear detonation is 8 rads per hour, and after 10 hours is 0.5 rads per hour; the zone of "strong" contamination, or Zone B, where the outside border line has a radiation level of 400 rads and the dose rate one hour after the detonation is 80 rads per hour and after 10 hours is 5 rads per hour; and the zone of "dangerous" contamination, or Zone C, where at the outside border line the level of radiation is 1200 rads and the does rate one hour after the detonation is 240 rads per hour and after 10 hours is 15 rads per hour.⁶⁵ It is said, therefore, that people in Zone A will be able to leave the shelters in ten hours and return to their homes,⁶⁶ but should not leave the latter for more than four hours during the first day. In Zone B people should remain in the shelters up to three days and then not leave their homes for more than three-four hours a day for the next few days. In Zone C, people will remain in the shelters for three to five days.⁶⁷ Soviet manuals note, however, that at a radiation rate of 240 rads per hour one hour after the detonation, it will require a week for the rate to decline to a level of 0.6 rads per hour, and that a rate of 610 rads per hour one hour after the detonation will require four weeks to decline to a level of 0.4 rads per hour.⁶⁸

The length of time that individuals will be able to remain in the shelters will depend on a number of factors. A critical question affecting the duration of shelter occupancy will be whether the external water and sewage systems are destroyed. If they are destroyed, shelter occupants will depend on the reserve water supply and septic tanks in the shelter, which are likely to be adequate for only a short time, i.e., only a few days at most. The reserve facilities in permanent shelters of industrial enterprises required to maintain production in wartime, and in command posts and shelters for the elite may be better, but it is doubtful that they would suffice for more than two weeks of occupancy. Of course, where external water and sewage systems are not destroyed and the shelters are equipped with water wells, the duration of occupancy would not be similarly restricted.

⁶⁵Titov, et al., *Grazhdanskaia Oborona*, p. 25.

⁶⁶Krotkov, *Meditinskaia Sluzhba*, p. 20. According to Titov, et al., p. 68, people should remain in the shelters "up to one day."

⁶⁷Titov, et al., *Grazhdanskaia Oborona*, p. 68.

⁶⁸Egorov, et al., *Grazhdanskaia Oborona*, p. 82.

Another factor which may limit the duration of shelter occupancy is the availability of food reserves in the shelters. There appears to be no uniform requirement for maintaining specific amounts of food stocks in the shelters. Soviet manuals indicate that basement shelters in apartment buildings are not normally prestocked with food. Civil defense instructions to the population specify that when taking cover in such shelters the people should take along a three-day supply of food. It is possible, however, that if time permits, additional food may be stored in such shelters.⁶⁹ The same problem faces persons taking cover in the subways, tunnels, underground pedestrian walkways, and so on. In the case of shelters in factories and large institutions, the food problem appears to be solved by making use of supplies belonging to the canteens and restaurants of the factories or institutions. This is especially true in the case of shelters designed for long-term occupancy, which are said to be provided with reserves of food.⁷⁰ For example, in the course of a large scale shelter exercise in the town of Lytkarino, near Moscow, it was reported that "the workers and employees" took cover in shelters which had been provided with "a long-term supply of food and drinking water."⁷¹ As was noted, it is also recommended that some food and water be stored in fallout shelters, which would be easiest to do in the case of single family shelters, but less practical in the case of public shelters. The limitations on the food supply suggest that even with strict rationing, people in apartment house basement shelters would probably not be expected to remain there for more than five days. The maintenance of discipline in the shelters in regard to food and water is one of the responsibilities of the civil defense shelter teams.

In assessing Soviet views on the likely duration of shelter occupancy, it should be kept in mind that one of the primary functions of the massive post-strike operations of Soviet civil defense forces is the rescue and evacuation of persons in surviving shelters in the zone of nuclear damage. Such operations will include efforts to decontaminate passages into the disaster area and to the shelters. Of course, the

⁶⁹Krotkov, *Meditinskaia Sluzhba*, p. 111.

⁷⁰Ibd.; F. Il'iasov, "When Acting with Self-Assurance," *Voennoye Znanie*, No. 11, November 1976, p. 26.

⁷¹Captain V. Zhitarenko, "Civil Defense Readiness," *Krasnaia Zvezda*, January 21, 1976.

actions of the rescue teams themselves will be constrained by the existing levels of radiation. It also appears that, as in the case of other Soviet civil defense measures, so in the matter of capabilities for long-term shelter occupancy, the authorities clearly favor those elements of the population which they believe to be most valuable to the state.

Shelter Construction and Availability

There is good evidence indicating that, since the 1950s, the Soviet Union has built shelters in conjunction with the overwhelming majority, if not all, industrial enterprises, including those producing consumer goods, and that a great many shelters have been built in public, office, and communist party buildings, schools and institutions of higher learning, research facilities, stores and apartment buildings. It seems highly probable that there is ready shelter space for at least one workshift at most or all industrial enterprises. The Soviet practice of digging deep foundations and constructing basements in multistory buildings greatly facilitates the construction of shelters or the conversion of basements into shelters. The evidence indicates that in the 1970s, if not before, the earlier rule requiring the approval by civil defense staffs of all construction plans and the compulsory construction of shelters in new factories, office buildings and large apartment houses has been reestablished.⁷²

Soviet publications mention the existence of shelters in all parts of the Soviet Union. These include not only large cities, but also smaller towns and collective or state farms. For example, the issues of the monthly journal *Voennoye Znaniia* for the year 1976 mention shelters in thirty different localities in the Soviet Union, with additional ones being reported in the newspapers, such as *Red Star* and *Soviet Patriot*. A detailed description of civil defense activities at the Moscow First State Ball Bearing Plant, published in 1975 in 243,100 copies, reports

⁷²See Colonel V. Postigan', "The Director Led the Exercise," *Voennoye Znaniia*, No. 6, June 1975, p. 36; A. Bogachev, "What Can Be Foreseen," *Voennoye Znaniia*, No. 7, July 1975, p. 23.

not only the availability of shelters at the plant but plans for the construction of additional ones for the workers' settlement and during the course of the renovation and modernization of the plant, as well as the building of a "large underground pedestrian passage-shelter," of a vehicular tunnel and underground garage to be used as a shelter; the "adaptation of all available basements in production and residential buildings as shelters"; the construction of underground wells and reservoirs and compressor stations, etc.⁷³ In Moscow construction is in progress on large multistory underground complexes of stores, warehouses, garages, transportation tunnels and walkways and service areas, which, in all probability, will be adapted for shelter purposes.⁷⁴ Published Soviet accounts of exercises also report the widespread existence of ready fallout shelters at collective and state farms, in some instances with sufficient space for urban evacuees. Possibly indicative of progress made in developing ready shelter space capacity is the account of an exercise held in 1975 in the town of Lytkarino (population about 40,000) near Moscow, where a test alert in one district with a population of some 14,000 is said to have demonstrated that there was sufficient ready shelter space for everyone.⁷⁵

In order to expedite the availability of ready shelter space, the Chief of USSR Civil Defense, Altunin, urged that advantage be taken of the stepped-up civil defense training program instituted in 1973, in order to build more hasty shelters as a part of the training exercises. He wrote that

In the course of the preparation and execution of complex factory exercises it is *obligatory* to carry out the forced-draft construction of protective structures and training sites.⁷⁶

He proposed that these hasty shelters be progressively improved and strengthened, in order to "gradually" transform them "into real permanent protective installations," and that the exercises also be used to carry out the "adaptation of cellars and basements into fallout

⁷³Gromov and Krechetnikov, *Grazhdanskaia Oborona Promyshlennogo Obekta*, *passim*.

⁷⁴*Pravda*, August 23, 1973; A. Blokhin, "Underground Streets," *Izvestia*, April 10, 1974.

⁷⁵*Krasnaia Zvezda*, January 21, 1976; *Sovetskiii Patriot*, September 6, 1976.

⁷⁶Altunin, "On the Basis of What Has Been Achieved," *Voennye Znaniia*, No. 10, October 1975, p. 4.

shelters."⁷⁷ One reason for taking advantage of exercises for this purpose is that the "complex" exercises which are now part of the standard training program are of two or three days' duration, with the first phase usually lasting one day and simulating conditions under a "threat of war" alert, during which the program calls for the construction of hasty shelters to supplement the ready permanent shelters.⁷⁸ Photographs published in *Voennye Znaniia* of such hasty shelters show them being built of large reinforced concrete blocks in deep excavations.⁷⁹ Soviet descriptions of the exercises frequently mention the construction of such shelters, which the population is taught how to build. The exercises also serve to speed up the completion of shelters already under construction.⁸⁰

Soviet commentaries indicate, however, that the shelter construction program has not been completed at this time. While the number of ready shelters is reported to be increasing from year to year,⁸¹ Soviet publications cite instances where shelter construction is proceeding very slowly or has been delayed. For example, the First Secretary of a city district committee of Baku, Azerbaijan SSR, complained in August 1975 that "at some enterprises" not all is well "in building up the inventory of protective structures and their maintenance."⁸² The Chairman of the Latvian SSR Council of Ministers wrote in February 1976 that "there is no point in concealing the fact that until recently cellars, basements and underground facilities at certain collective farms were not adapted for the protection of the population and food supplies."⁸³ The inspection of shelters leased for use as storage or for production reveals instances of violation of the rental terms, resulting in damage to the filter-ventilation units or the

⁷⁷Ibid., Altunin, "The Main Direction," *Voennye Znaniia*, No. 12, December 1973, p. 5.

⁷⁸Major-General O. Nikolaiev, "Organizational Principles for Comprehensive Exercises at Installations; How to Prepare for and Conduct Such Exercises," *Voennye Znaniia*, No. 3, March 1976, p. 18.

⁷⁹*Voennye Znaniia*, No. 5, May 1975, p. 39, and No. 9, September 1975, p. 21.

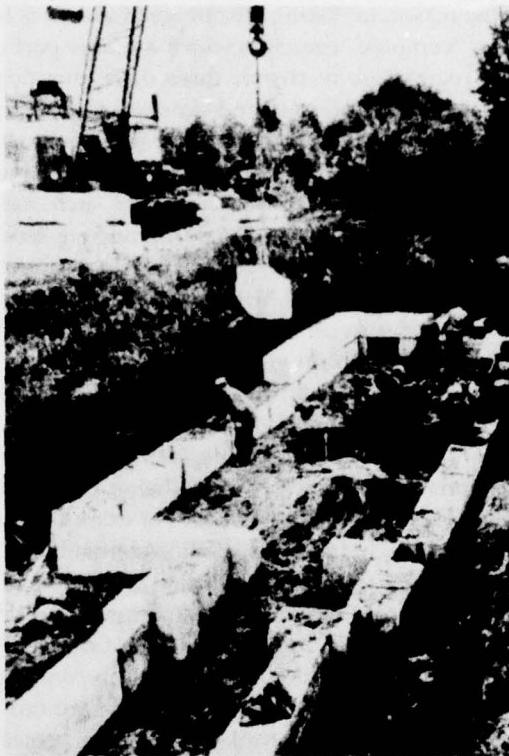
⁸⁰Zaitsev, "The First Lessons," *Voennye Znaniia*, No. 6, June 1976, p. 18.

⁸¹For example, see D. Fanyan, "To Find Support in the Aktiv," *Sovetskaia Moldavia*, October 10, 1975; Stalauskas, Radio Vil'nius, November 26, 1976.

⁸²N. Nadzhafov, "According to a Thorough Plan," *Voennye Znaniia*, No. 8, August 1975, p. 17.

⁸³Iu. Iu. Ruben, "Concern for a High Degree of Readiness," *Sovetskii Patriot*, February 4, 1976.

Hasty Shelter Under Construction



blocking of entrances, which would delay the preparation of the shelters for occupancy.⁸⁴ The conduct of the Soviet exercises also reveals that the local civil defense staffs are given advance warning, so that they have time to bring the shelters into a state of readiness before the start of the exercises.

Obviously, the availability of sufficient shelter space for the "entire" urban population is not only a question of numbers of shelters, but also of their location, so as to insure that the population can be protected effectively, regardless of the time of day and the movement of people. Altunin indicates that this is a goal of the Soviet civil defense program, but does not set any date for its completion. Even

⁸⁴N. Kalinina and P. Gorbunov, "Take Care of the Protective Facilities," *Voennoye Znanie*, No. 8, August 1976, p. 23.

so, indications are that a considerable fund of ready shelter space is presently in existence, and that it is being added to at an accelerated rate. Thus, even while criticizing the concern over Soviet civil defense in the U.S. as a "provocative campaign" and a "propagandistic ballyhoo," Army General A. I. Radzievskii, Chief of the Frunze Military Academy admitted in January 1977 that civil defense "methods of protecting the population and the national economy against attacks" are "constantly being improved."⁸⁵

⁸⁵Literaturaia Gazeta, January 19, 1977.

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